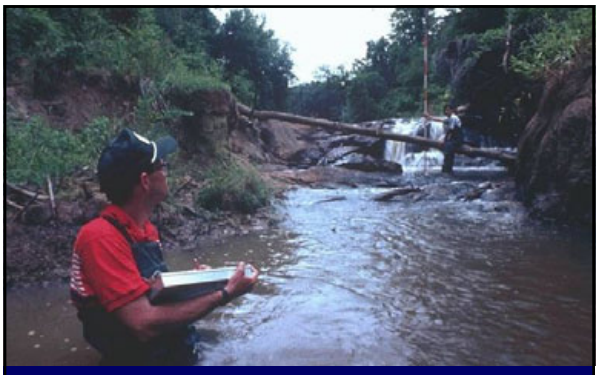


Tools to Help Watershed-Based NPS Planning

Presentation Objectives:

- Nonpoint Source Pollution Impacts
- Watershed Planning Approach
- Tools for Assessment
- Tools for Planning
- Tools for Implementation

Impacts of NPS Pollutants on Aquatic Habitat:

- Leading Cause of impairment
- US Water bodies impaired by habitat degradation
- Many aquatic species classified vulnerable, imperiled, or endangered in North America

50% water bodies are impaired by habitat degradation including NPS

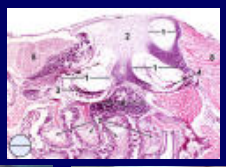
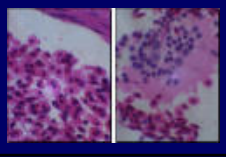
37% Fishes, 73% Mussels 65%, Crayfish and 35% Amphibians are vulnerable

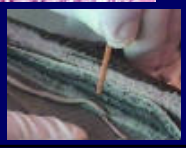
30% Fish species are threatened or endangered

Impacts of NPS Pollutants on Fish Population:

- **Physiological**
- **Behavioral**
- **Reproductive**

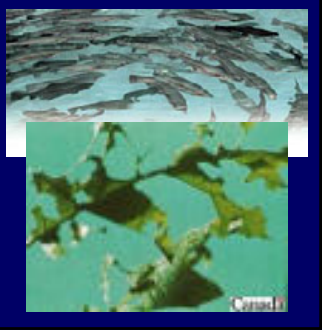
Physiological: Impaired fish growth, histological changes
alteration in blood chemistry, parasitism and resistance, respiratory functions



Behavioral: variation and alteration in Habitat.

Behavioral: Stress, disruption of territoriality, reduction in feeding and energy reserve



Reproductive: Fish egg survival rate, death, embryo development, and larval survival

Impacts on Invertebrates:

- **Alteration in community structure**
- **Reproduction and growth rate**
- **Feeding Efficiency**
- **Behavior**

Invertebrates: alteration in community structure biomass, and diversity

Invertebrates: reproduction, growth

Invertebrates: Behavioral and changes in substrate composition, feeding efficiency, clogging and filtration

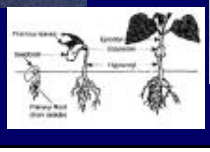
Impacts on aquatic plant species:

- Reduction in aquatic plant species
- Quality of aquatic plants
- Reduce the reproductive capacity
- Seed germination, emergence, and establishment

Aquatic plants: Reduction in species density, biomass, and diversity

Aquatic plants: decline quality, growth, vegetation, plant community colonization, reproductive capacity

Seed germination, emergence, and establishment



Impact on primary productivity:

- Reduce the penetration of light
- Reduce the primary productivity
- Reduction in energy inputs to next tropic level
- Cause decrease in zooplankton, macro invertebrate

Impact on primary productivity:

Reduced energy inputs in next tropic level

Economic and social impacts of NPS Pollution:

- Number one source of pollutant for river and stream and
- Number two pollutant for lakes and reservoirs
- Onsite loss- several billions/year
- Offsite loss- six billion per year in USA

What need to consider?

- Focus on impaired waters
- Watershed plans before BMPS are selected
- 319-funded work plans based on the overall watershed plan

Watershed Planning Approach

- Think about big pictures
- What do we know?
- what should be preliminary goals and objectives
- Other Perceptions?
- Required Load reductions
- BMPs applicable and cost effective
- Implementation Strategy

Focus on:

- Quantitative analysis of current loadings Estimates of pollutant
- Load reduction potential of specific, planned BMPs
- Phased implementation of the watershed plan

Why Watershed Approach is used?

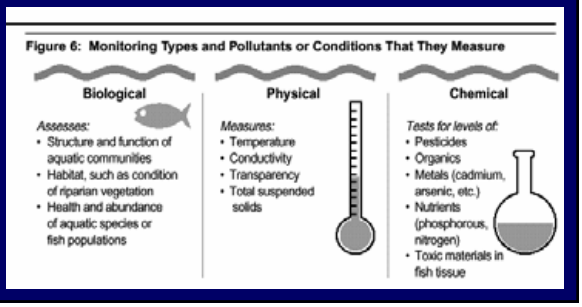
- Focuses on the resource, not the program
- Based on Sound Science
- Depend on data collection efforts
- Focus on environmental results
- Partnerships/stakeholder
- Provide Means of Cost-Effective Management

Watershed-Based NPS Plans

a. Identify stressors & sources to be controlled
b. Estimate load reductions expected from BMPs
c. Describe mgmt measures & targeted critical areas
d. Estimate TA, $$, & source required for implementation
e. Describe info & education needed to promote BMPs
f. Develop schedule for implementation of BMPs, assign tasks
g. Describe interim, measurable milestones
h. Identify criteria to measure progress
i. Develop monitoring component

Source: US EPA 2004 319 Supplemental Guidelines

Tools for Watershed Assessment



Types of Data for Watershed Characterization

- **Physical and Natural Features**
  - Watershed boundaries
  - Hydrology
  - Topography
  - Soils
  - Climate
  - Habitat
  - Wildlife
- **Land Use and Population Characteristics**
  - Land use and land
- **Waterbody Conditions**
  - Water quality standards
  - 305(b) report
  - 303(d) list
  - TMDL reports
  - Source Water Protection Areas
- **Pollutant Sources**
  - Point sources
  - Nonpoint sources
- **Waterbody Monitoring Data**
  - Water quality data

Review Data and Identify Gaps

- Enough data to start the analysis?
- Quality of the data?
- Do we need to collect more data?
- Conduct visual assessments
- Research local knowledge

Analyze the Data

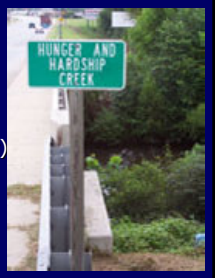
- Types of Data Analysis
  - Summary Statistics
  - Spatial Analysis
  - Temporal Analysis
  - Stressor Identification
- Use a combination of techniques
- Consider geographic variations
- Revisit stakeholder concerns

Examples of Sources You Might Miss Without a Watershed Tour

- Streambank erosion
- Straight pipes
- Livestock (near or with access to streams)
- Wildlife (e.g., waterfowl populations on lakes and open streams)
- Illegal dumping

Characterizing causes & sources

- By "loads"
  - Kilograms per day
  - Pounds per week
  - Tons per month
- Or by other means . . .
  - Concentration-based expression of the "load" (e.g., milligrams per liter)
    - mg/L x L/day = mg/day [C = m/v]
  - # of miles of streambank needing stabilization or vegetation
  - # of AFOs requiring nutrient plans
  - % of urban area to be 'perforated'



Understanding pollution sources

- Point-source discharges (NPDES facilities)
  - Info is available on the discharges (DMRs, etc.)
  - Some are steady-flow, others are precip-driven
- Nonpoint sources (polluted runoff)
  - All are (mostly) precip-driven
  - Calculating the "wash-off, runoff" load is tough!
  - Literature values & etc. can be used to estimate
  - Tribes can use BPJ and narrative descriptions
- Air / atmospheric deposition
  - Can be significant in some locations

Selecting & Implementing BMPs

- Integrate assessment results across objectives
- Example factors to consider:
  - Highest threats to achieving objectives
  - Regulatory requirements
  - Where are existing management regulations, programs, policies, practices falling short
  - Stakeholder preferences

Asking the right questions…

- Who can help implement the BMPs or controls?
  - Agencies, businesses, non-profits, citizens, producers
- How can they be implemented?
  - What has been done in the past?
  - How well did it work?
  - Can we do it (or adapt it) here?
- When can we get started?
  - Reasonable short-term actions
  - Long-term or major actions
- How do we know if it's working?
  - And what do we do if it's not?

Setting times and targets

- Develop implementation schedule
  - Think about short term (< 2 yrs) and long-term (> 5 yrs) goals
- Determine how you will measure success
  - What indicators are linked to the problems you're dealing with?
- Set interim milestones
  - What helps to show progress?
  - Can be both water quality & programmatic indicators

Implementation Plan

- Public outreach, information & education
- Public involvement
- Support for:
  - BMPs
  - $$$$
  - Technical Assistance
- Project schedule
- Project costs

Technical and Financial Resources Needed

- Satisfies element "d"
  - Estimate of the amounts of technical and financial assistance needed, associated costs, and/or the sources and authorities that will be relied upon to implement this plan.
- Include:
  - Administrative/management services (salaries, supplies, office space)
  - I/E efforts
  - BMP costs including O&M
  - Monitoring and data mgmt costs
  - Coordinate with other authorities

Identify sources of support

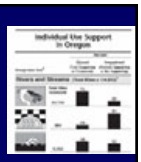
- Funding sources
  - Grants, contracts, donations
  - Private foundations
- Sources of technical assistance
  - Internal and external
- Regulatory or other authority
  - Tribal codes, onsite regs
  - WHPP, SWPP, etc.
- Matching support sources
  - Be creative!

Estimating costs

- Categorize/classify costs
  - According to project phases
  - By stressor targeted
  - By BMP type, or other scheme
- Use estimated costs or averages
  - Appropriate for area/region
  - Based on past actual costs if available
- Include full costing
  - Design, installation, maintenance, site access, etc

Tools for Implementation

- Define overall goal and objectives
- Identify & characterize target audience
- Create message(s) for target audience
- Package the messages for distribution
- Distribute messages to the audiences
- Evaluate the info/education effort



Coordinate with other water resource and land use programs

- Section 303, Water Quality Standards, TMDLs
- Section 319, NPS Program
- Section 402, KPDES Permits, CAFOs, Stormwater I & II
- Source Water Protection Plans – local water utilities
- Wetlands Protection Programs
- EQIP, CRP, BLM, USFS, USFWS
- More…

Form partnerships

- Benefits of partnerships
- Coordinated/leveraged monitoring
- Integrated assessment and problem ID
- Joint problem targeting/prioritization
- Focused goal-setting
- More help with BMPs
- Better long-term mgmt
- Buy-in & ownership

During implementation, remember:

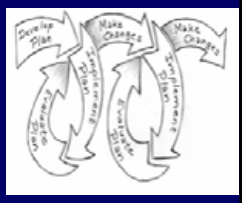
- Plans are guides, not straitjackets
- Be aware of unforeseen opportunities
- Picking the low-hanging fruit is easy, but it helps to build a sense of progress & momentum
- If possible, work quietly for as long as you can on the most contentious issues

How do we measure progress?

- With indicators that:
  - Characterize the watershed
  - Define and/or refine your understanding of the problem(s), such as WQ criteria violations, etc.
  - Show changes in targeted water quality or habitat conditions
  - Efficiently provide effective management information

Finally…Make Adjustments

- Monitor water quality and BMPs
  - Compare results to goals
  - Are you making progress?
  - Are you meeting your goals?
- If you aren't meeting implementation milestones
- If you aren't making progress toward reducing pollutant loads….

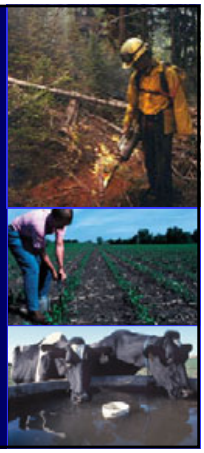


Share Results

- Transparency builds trust and confidence in the outcome
- Show them it is making a difference
- Report cards, fact sheets, meetings, etc.

Conclusion:

- Load reduction *estimates* are critical for nonpoint sources
- Preliminary info & estimates can be modified & corrected over time, if necessary
- NPS 319 - funded management measures should proceed only after reasonable estimates are made of how far they will go towards achieving water quality targets.



Questions and Discussion:

Additional Materials:

References for potential sources of pollution

Monitoring & adaptive management

- Interim measurable milestones
  - Load reduction targets
- Monitoring component
  - Who will help with monitoring?
  - Measuring your chosen indicators
- Develop evaluation framework
  - Indicator targets vs. collected data

Example milestones

- Short-term (<1 yr)
  - Achieve 5% reduction in sediment load on 1,000 acres of ag land in the Cross Creek watershed by implementing rotational grazing practices.
- Mid-term (1-4 yrs)
  - Reduce streambank erosion and sediment loading rate by 15% by reestablishing vegetation along 3,600 feet of Cross Creek.
- Long-term (>5 yrs)
  - Restore upper reaches of 6 tributaries and create buffer easements along 15,000 ft of Cross Creek feeder streams.

Planning to git 'r done!

Worksheet 12-1

Sample Implementation Plan Matrix

Watershed Goals
Goal 1: Restore water quality to meet designated uses for fishing
Objective 1: Reduce sedimentation by 20 percent

Tasks for G1/O1	Respon. Party	Total Costs	Funding Mechanism	Indicators	Milestones			
					Short < 1 yr	Med < 3 yr	Long < 7 yr	Remaining
Task 1 Seek donation of conservation easements from property owners along Baron Creek	Local land trust	$0		# acres donated	2	7	10	10
I/E Activities Task 1 Hold informational workshop with property owners Develop brochures on how to donate easements	Local land trust	$3,000	Sect. 319 funding	# workshops held # participants # requests for assistance	3 40 2	3 45 4		0
Task 2 Purchase greenway alongside Baron Creek	County park district	$2,000/ mile	County general funds	# miles purchased	2	4	7	5
I/E Activities Task 2 None								

Table 8-2. Comparison of example parameters in a hypothetical watershed plan and 319 work plan

Parameter	Lake Lehmann Watershed Management Plan	319 Work Plan #1
Period	2003 -2013	2003 - 2006
Geographic scope	180,000 acres	24,000 acres
Goal statement	Improve watershed conditions to support a sustainable fisheries	Reduce sediment loadings from priority subwatershed XY
Example objectives and key elements	• Increase the index of biological integrity from 30 to 75 • Identification of causes and sources of sediment • Identification of load reduction expected • Identification of management practices needed • Identification of critical areas	• Treat 5,000 acres of cropland with crop residue management (CRM) practices • Six terraces to treat 1,200 acres • Five buffer strips established for a total of 8,000 feet
Implementation	• CRM: 2,000 acres of row crop/year into CRM • Terraces: 4 fields/year, 40 fields total • Buffers: restore 1 to 1.5 miles of riparian area/year – 8 miles total • Field buffers: 100 fields total	• Develop training materials on CRM in year 1 • Hold 2 workshop each in years 2 and 3 • 2 terraces/year • 1 buffer strip in first year and 2 each in years 2 and 3
Costs	$4,020,000 over 10 years • $800,000 for information and education (I&E) • $600,000 for monitoring and reporting • $1,980,000 for buffers (18,000 acres at $110 / acre) • $140,000 for 40 terraces • $500,000 for CRM	$250,000 over 3 years • $50,000 to prepare training materials and give 5 workshops on CRM • $160,000 for BMP cost sharing • $40,000 for monitoring and reporting
Schedule	• Begin slowly and accelerate (build on successes) • Establish interim milestones • Cropland: 2008 – reduce soils erosion by 80,000 tons/year	• See above • Annual progress reports

Table 2-2. Summary of Common Pollutants and Sources

Pollutant	Potential Sources		Impacts on Waterbody Uses
	Point Sources	Nonpoint Sources	
Pathogens	• WWTPs • CSOs/SSOs • Permitted CAFOs • Discharges from meat processing facilities • Landfills	• Animals (domestic, wildlife, livestock) • Malfunctioning septic systems • Pastures • Boat pumpout facilities • Land application of manure • Land application of wastewater	• Primarily human health risks • Risk of illness from ingestion or from contact with contaminated water through recreation • Increased cost of treatment of drinking water supplies • Shellfish bed closures
Metals	• Urban runoff • WWTPs • CSO/SSOs • Landfills • Industrial facilities • Mine discharges	• Abandoned mine drainage • Hazardous waste sites (unknown or partially treated sources) • Marinas	• Aquatic life impairments (e.g., reduced fish populations due to acute/chronic concentrations or contaminated sediment) • Drinking water supplies (elevated concentrations in source water) • Fish contamination (e.g., mercury)
Nutrients	• WWTPs • CSOs/SSOs • CAFOs • Discharge from food- processing facilities • Landfills	• Cropland (fertilizer application) • Landscaped spaces in developed areas (e.g., lawns, golf courses) • Animals (domestic, wildlife, livestock) • Malfunctioning septic systems • Pastures • Boat pumpout • Land application of manure or wastewater	• Aquatic life impairments (e.g., effects from excess plant growth, low DO) • Direct drinking water supply impacts (e.g., dangers to human health from high levels of nitrates) • Indirect drinking water supply impacts (e.g., effects from excess plant growth clogging drinking water facility filters) • Recreational impacts (indirect impacts from excess plant growth on fisheries, boat/swimming access, appearance, and odors) • Human health impacts

Pollutant	Potential Sources		Impacts on Waterbody Uses
	Point Sources	Nonpoint Sources	
Sediment	• WWTPs • Urban stormwater systems	• Agriculture (cropland and pastureland erosion) • Silviculture and timber harvesting • Rangeland erosion • Excessive streambank erosion • Construction • Roads • Urban runoff • Landslides • Abandoned mine drainage • Stream channel modification	• Fills pools used for refuge and rearing • Fills interstitial spaces between gravel (reduces spawning habitat by trapping emerging fish and reducing oxygen exchange) • When suspended, prevents fish from seeing food and can clog gills; high levels of suspended sediment can cause fish to avoid the stream • Taste/odor problems in drinking water • Impairs swimming/boating because of physical alteration of the channel • Indirect impacts on recreational fishing
Temperature	• WWTPs • Cooling water discharges (power plants and other industrial sources) • Urban stormwater systems	• Lack of riparian shading • Shallow or wide channels (due to hydrologic modification) • Hydroelectric dams • Urban runoff (warmer runoff from impervious surfaces) • Sediment (cloudy water absorbs more heat than clear water) • Abandoned mine drainage	• Causes lethal effects when temperature exceeds tolerance limit • Increases metabolism (results in higher oxygen demand for aquatic organisms) • Increases food requirements • Decreases growth rates and DO • Influences timing of migration • Increases sensitivity to disease • Increases rates of photosynthesis (increases algal growth, depletes oxygen through plant decomposition) • Causes excess plant growth

Note: WWTP = wastewater treatment plant; CSO = combined sewer overflow; SSO = sanitary sewer overflow; CAFO = concentrated animal feeding operation; DO = dissolved oxygen.

Table 9. Unit loads of pollutants (kg/ha/yr) from different land uses*

Pollutant	Central business district	Other commercial	Industrial	Single family res.	Multi-family res.	Cropland	Pasture	Forest	Open
TSS	1080	840	56	17	440	450	340	85	7
COD	1070	1020	63	28	330	n.a.	n.a.	n.a.	2.0
Pb	7.1	3.0	2.0 - 7.1	0.1	0.7	0.005 - 0.006	0.003 - 0.015	0.01 - 0.03	n.a.
Zn	3.0	3.3	3.5 - 12	0.22	0.33	0.03 - 0.08	0.02 - 0.17	0.01 - 0.03	n.a.
Cu	2.1	n.a.	0.33 - 1.1	0.03	0.33	0.01 - 0.06	0.02 - 0.04	0.02 - 0.03	n.a.
NO_3+$N0_2$-N	4.5	0.67	0.45	0.33	3.8	7.9	0.33	0.56	0.33
TKN	15	15	2.2 - 15	1.1 - 5.6	3.4 - 4.5	1.7	0.67	2.9	1.7
TP	2.8	2.7	0.9 - 4.0	0.2 - 1.5	1.3 - 1.6	0.1 - 3.0	0.07 - 3.0	0.02 - 0.45	0.06

* Exact values are given where available; otherwise ranges are reported.

Adapted from Horner et al. (1986)

Who will implement the plan?

Structure can vary widely

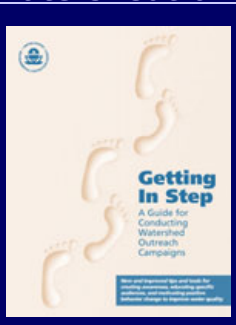
- Public agencies
  - Cities, counties
  - Water or wastewater utility
  - State agency or river authority
  - Basin planning teams
- Private entities
  - Watershed association
  - Ag producer council

Any well-organized single or multiple entity approach
can coordinate and document the effort

Why an information/education component?

- Communication helps each step proceed more smoothly
- Dialogue can identify unknown resources/problems
- Promotion of the process builds understanding, support
- Watershed work requires an inclusive, transparent, cooperative, methodical approach
- Motivation is needed where adoption of BMPs is voluntary

www.watershedtraining.net



www.epa.gov/owow/watershed/outreach/documents

Indicators & targets for management objectives

INDICATOR = measurable parameter used to evaluate relationship between pollutant sources and environmental conditions

TARGET = value of indicator that is set as the goal to achieve

Environmental and Social Indicators

- Environmental Indicators:
  - # of occurrences of algal blooms
  - miles of streambank restored or fenced off
  - % increase in "healthy-stream" critters
  - Increase in DO
  - # of waterbodies restored
- Social Indicators:
  - # of calls reporting illegal dumping
  - # of people surveyed with increased knowledge of watershed issues
  - # of people who report picking up pet waste
  - % increase in households who had their septic tanks inspected

Other types of indicators

- Administrative/programmatic indicators
  - # of BMPs installed
  - # of newspaper stories printed
  - # of people educated/trained
  - # of public meetings held
  - # of volunteers attending activities
  - # of storm drains stenciled

Indicators & targets: short/long term

Worksheet 12-2

Developing Criteria to Measure Progress in Meeting Water Quality Goals

[Note: Complete one worksheet for each management objective identified.]

Management Objective: Reduce nutrient inputs into Cane Creek by 20 percent

Indicators to Measure Progress	Target Value or Goal	Interim Targets		
		Short-term	Medium-term	Long-term
P load	44 t/yr	52 t/yr	49 t/yr	44 t/yr
# of nuisance algae blooms	0	2	1	0
transparency	5.5 m	4.1 m	4.9 m	5.5 m
frequency of taste and odor problems in water supply	0	1	1	0
hypolimnetic DO	5.0 mg/L	2.5 mg/L	4.0 mg/L	5.0 mg/L

Estimating Costs

BMP cost information

- http://www.lacity.org/SAN/wpd/pages/publctns.htm
- http://www.swrcb.ca.gov/stormwtr/post_construction.html
- http://www.georgiastormwater.com
- http://www-agecon.ag.ohio-state.edu/people/sohngen.1/bmp/bmpinfo.htm
- http://www.cwp.org/stormwater_mgt.htm
- http://www.cffm.umn.edu/landeconomics/readings/forestcosts.pdf
- http://tti.tamu.edu/product/catalog/reports/1837-1.pdf

Funding Sources on the Web

- Catalog of Federal Domestic Assistance (www.cfda.gov)
- Federal funding for watersheds (www.cfpub.epa.gov/fedfund)
- Directory of Funding Sources for Grassroots River and Watershed Groups (www.rivernetwork.org)

Gather Data

- Build on earlier efforts
  - What has already been done?
  - Existing data sets and reports
    - Septic system inventories
    - 305(b) report
    - Wetland inventories
- Consider stakeholder concerns

Gather Data, cont.

- Who has the data?
  - Tribe
  - Neighboring county or town/city agencies
  - State agencies
  - Federal agencies
  - Area environmental or watershed organizations

Sample Data Sources

- Watershed Coverages:
  - 8-digit: http://water.usgs.gov/GIS/huc.html
  - 14-digit: www.ncgc.nrcs.usda.gov/products/datasets/watershed
  - Check tribal or state agencies for small watershed coverages
- EPA Reach Files
  - I.D. and interconnect the stream reaches all over U.S.
  - 3 versions RF1, RF2, RF3-Alpha (most detailed)
  - www.epa.gov/waterscience/ftp/basins/gis_data/huc/
- Elevation Data
  - USGS: http://edc.usgs.gov/geodata
  - GIS data depot: http://data.geocomm.com
- Land Use/Population
  - USGS: http://edc.usgs.gov/geodata

Other Data Sources

- State 303 (d) lists and TMDL reports
  - www.epa.gov/owow/tmdl
- Point source discharge permits
  - www.epa.gov/enviro/html/pcs/index.html
- Census of Agriculture
  - www.nass.usda.gov/census
- Septic tank use
  - http://quickfacts.census.gov/

Review and Analyze Data

Minimum Element

a. An identification of the causes and sources or groups of similar sources that will need to be controlled to achieve the load reductions estimated in this watershed-based plan.

Tools for Planning

- Reasonable efforts needed to ID stressors/sources
- Assessment & other data don't have to be exhaustive, but should be indicative
- Preliminary info & estimates can be modified & corrected over time, if necessary